PROBLEMS OF TYMPANOPLASTY*

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I SHALL confine my remarks to certain problems of tympanoplasty showing some of the ways in which we have attempted to solve these.

The points chosen for discussion are:

1. Choice and preparation of the graft material.
2. Preservation or removal of the cholesteatoma matrix.
3. Tympanoplasty in a discharging ear.
4. Remarks concerning the type IV tympanoplasty.
5. Tympanoplasty in a radical cavity.
6. Treatment of the Eustachian tube; tympanoplasty with a closed Eustachian tube.

Choice and preparation of graft material

After exposure of the middle ear by the endaural or post-auricular route the size of the flap required for closure of the tympanum is estimated. Free grafts taken from the external auditory meatus are used exclusively. In practically all cases a flap of adequate magnitude can be obtained. Free grafts from the post-auricular fold as described by Wullstein yield much more material, not only for closure of the middle ear but also for lining the mastoid cavity. However, the use of such grafts as well as those taken from other sites like the arm, the leg, or the abdomen, is not without drawbacks. Post-auricular grafts appear to be especially suitable because they contain only few elastic fibres and hairs. Closure of tympanic defects and improvement in hearing may well be achieved by employing post-auricular skin; however, the formation of graft cholesteatomas has been observed by us and other authors in numerous cases. These graft cholesteatomas originate from the hair follicles and may be found years after the transplantation was performed. The presence of sweat and sebaceous glands in tissue intended to replace a part or the whole of the eardrum cannot be immaterial for the functional result. Therefore, in the past three years we have been using skin from the external meatus in over 700 cases. This skin is free of elastic fibres and does not contain hairs or glandular elements. Formerly we covered the middle ear with a meatal graft and used skin from behind the ear for lining the rest of the cavity.

* Paper presented to the Section of Otology, Royal Society of Medicine, on February 3rd, 1961.

https://doi.org/10.1017/S002221510005859X Published online by Cambridge University Press

Desquamation from such transplants into the cavity is often excessive, necessitating frequent ear toilet.

Moreover, after primary healing, sometimes after months, or even years, during the course of a cold the operated ear suddenly may start discharging again. On inspection of the cavity a thickened skin with eczematous changes is found. Often a permanent drainage from the ear persists. Therefore, any lining of the mastoid cavity has been abandoned in order to facilitate natural and resistant epithelialization. The absence of elastic fibres in the meatal skin allows cutting a graft of suitable size which will neither shrink nor curl up at the edges, as grafts from arm or leg will do, and thus it is easy to place into position.

This graft requires no preparation except trimming of edges as the under-surface consists only of a thin and smooth periosteal layer. A further advantage is that the epithelial layer of the eardrum can be removed right up to the margin of the perforation along with the meatal skin in one continuous piece. This both increases the size of the graft and ensures that the bed to be covered is entirely free of epidermal remnants which might lead to cholesteatoma formation. We have the impression that there is less tendency to form adhesions in the middle ear than with other grafting material due to the presence of periosteum.

We confine ourselves to closing off the tympanum, leaving the remaining cavity bare. The time it takes for the cavity to become fully epithelialized is only slightly longer and so far few cavities have become reinfected—certainly less than 10 per cent.

The more experience we obtained in dissecting and handling of the meatal flap the more recurrent perforations have been observed. The reason was, that with growing skill only the thinner parts of the meatal skin especially from the inner anterior and inferior portion of the canal were used. Therefore, today the meatal skin up to the hairline is taken advantage of, the thickest portion of the flap being used for the closure of large perforations. Small ones will heal with any portion of meatal skin.

In very large perforations the middle ear is first closed with a fascial transplant from the temporal muscle. It receives an additional nutritional basis on the promontory. This fascia then is covered with meatal skin.

After closing the middle ear with our graft the entire cavity is filled with gelatine sponge soaked in an antibiotic solution. This keeps the graft in position and is a protection against infection from outside. The packing is removed by suction 15 to 20 days after the operation. By then a small cavity may be found already fully epithelialized, but larger ones require sterile post-operative care to avoid formation of granulations which may cause considerable delay in healing.

Following general surgical principles skin from as near to the tympanum as possible is utilized for grafting. By the same reasoning we prefer middle-ear mucosa to any other mucous membrane in those exceptional

https://doi.org/10.1017/S002221510005859X Published online by Cambridge University Press

cases where mucosal transplants are required. In cases with marked adhesions, tympanosclerosis, or after extensive evacuation of hypotympanic cells usually a sufficient amount of mucous membrane from around the tympanic orifice of the Eustachian tube can be obtained. Other suitable donor sites are the epitympanic space or the region of the oval window (in tympanoplasties type IV).

Preservation or Removal of the Cholesteatoma Matrix

This has always been a debatable subject. Baron, in 1949, among others, stated that he preserves the matrix of a cholesteatoma. Later, in 1953, he emphasized his opinion which was supported by a series of macroscopic and microscopic studies. Zöllner expressed similar views in 1957. We also have had some good results from the use and preservation of cholesteatoma matrix. There are two different clinical manifestations of cholesteatoma which require different treatment. In one type the cholesteatoma has the appearance of a pea or a bean. After removal of the cholesteatomatous material the surface is smooth without any indentations. After lifting the matrix its undersurface is smooth also. In this type of cholesteatoma the matrix may be left in the attic, the aditus of the mastoid antrum, or in the antrum itself. Epithelialization of the cavity will thus be hastened. The retrotympanic spaces are always opened from the defect of the eardrum or the bony meatus. The posterior bony wall of the meatus is taken down as far as necessary to overlook the cholesteatoma completely. In the second type of cholesteatoma more infiltrative growth of the matrix can be observed. Here it has an irregular surface and portions of cholesteatoma fill the cells and niches of the retrotympanic spaces. In this more dangerous type of cholesteatoma every remnant of the matrix has to be meticulously removed under the microscope.

Tympanoplasty in a Discharging Ear

Most patients coming to hospital for ear surgery have been under the continuous care of an E.N.T. specialist up to the time of admission. Even so, many of them still have a moderate or heavy aural discharge. Antibiotic treatment, in spite of sensitivity studies, rarely stops the secretion or reduces the inflammatory changes of the tympanic mucosa. After Mr. Thorburn and Dr. Verhoeven visited our institution and after we came to know about the work of Mr. McGuckin we paid special attention to these wet ears. If the discharge is copious we deal with this by daily suctioning and removal of polypi before the operation. In some instances it is possible to considerably reduce the inflammation in the attic and tympanum proper by these means. In young people, however, the discharge is often resistant to this kind of conservative treatment, most of all in mesotympanic otitis media. If the attempts to get a dry ear before surgery

https://doi.org/10.1017/S002221510005859X Published online by Cambridge University Press

fail, there is the possibility of the flap being lifted from the perforation by pressure of the secretion in the middle ear. In such cases we drain attic and antrum through a drillhole in the mastoid plane. A tube leads the secretion to the outside. Through this tube it is possible to irrigate the antrum with antibacterial solutions or to ventilate the middle ear if the patency of the Eustachian tube is interfered with by swelling of the mucous membrane. The plastic tube is removed after suppuration has ceased, which in our experience takes 6 to 10 days. If necessary, the drillhole in the mastoid cortex may be enlarged and a simple mastoidectomy performed. The posterior wall of the external canal should not be touched in order to preserve its natural shape and prevent the necessity of regular cleanings for the rest of the patient's life.

Remarks Concerning the Type IV Tympanoplasty

In a tympanoplasty type IV there is not only considerable destruction of the ossicular chain but the mucous membrane of the middle ear is generally in poor condition also. Early and regular inflations are required to prevent adhesions and to insure good functional results. If the entire tympanic cavity has been covered with one single large graft, there is a danger of the air stream passing beyond the round window niche towards the oval window. A common airspace will connect the tube with both windows. Consequently poor hearing will result. To avoid this complication we first cover the Eustachian tube, hypotympanum and round window niche with one large piece of skin. After removal of the mucosa over the oval window it receives its own covering by a second small graft. With this technique even excessive inflations in the first post-operative days or later are of no harm. It is possible that the still loose transplant gets detached over the hypotympanum, but it will rapidly adhere again to its base. In any case the oval window remains covered by its own small flap. Conservation of cholesteatoma matrix over the oval window is to be recommended in rare instances only. Usually the underlying mucosa is thickened and often contains cysts filled with a yellowish liquid. In these cases we prefer to remove the matrix along with the underlying mucosa from over and around the oval window and cover this area with a small meatal graft.

In infected ears we have not had any good results from the interposition of plastic tubes in the type IV attempting to convert a type IV into a type III tympanoplasty. In almost 200 cases of otosclerosis we have replaced the stapes by a plastic tube and no adverse reactions have been observed so far. It seems that foreign material should not be used if there is inflammation in the middle ear. In some cases a plastic columella was placed in the middle ear with good results after healing had first been completed.

https://doi.org/10.1017/S002221510005859X Published online by Cambridge University Press

Problems of Tympanoplasty

Tympanoplasty in Radical Cavities

Sometimes the revision of a radical cavity and performance of a tympanoplasty is quite gratifying. This should be considered if there is a purulent aural discharge or the hearing is greatly reduced. We have done revisions of radical cavities in 94 patients who had had a persistently running ear. In 68 per cent. the secretion originated predominantly from the tympanic cavity or the Eustachian tube. In the remaining 32 per cent. there were granulations in the mastoid cavity. The revision consisted of complete removal of the diseased epithelium and any cells which had been missed in the first operation. If cochlear function was still good the tympanum was then covered with a meatal graft according to the principles of tympanoplasty. In cases with poor cochlear function tympanic mucosa was removed by curetting. The Eustachian tube was also curetted as deeply as possible in order to assure good healing of the transplant. The result was surprising: 90 out of the 94 patients obtained dry ears. Disappointing, however, are the results of revisions of wet cavities as far as hearing is concerned: only 48 per cent. of our patients reached a serviceable hearing level. In a dry radical cavity with a severe hearing loss and good bone conduction, adhesions in the hypotympanum or no pressure difference between round and oval window are usually found. In cases of hypotympanic adhesions the connection between the tympanic orifice of the Eustachian tube and the round window is re-established by lifting up the epidermal layer. Early inflations are imperative, starting on the first post-operative day, otherwise the adhesions will form again. In five out of 13 cases we saw recurrent adhesions. In 10 cases both windows were in continuity with the air-space from the Eustachian tube and covered by a pseudomembrane adherent to the promontory. This membrane was mobilized towards and around the oval window and brought in contact with the promontory. The mucous membrane in the oval window niche is taken out and the footplate covered with a patch of meatal skin again.

Treatment of the Eustachian Tube; Tympanoplasty with a Closed Eustachian Tube

The most frequent cause of an unsuccessful tympanoplasty is partial or even complete closure of the Eustachian tube. Before surgery we impress on our patients the importance of adequate middle-ear ventilation and teach them how to do the Valsalva manœuvre. Even children under 10 years will usually learn how to inflate their tubes. In children and adults below the age of 20 sometimes radiation of the tubes with X-rays had been helpful. We apply a total of 300 roentgen in 10 sessions at intervals of one week.

We have no experience with the application of Strontium 90 as described by Zöllner, neither with dilatation of the tube with bougies.

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Surgical widening of the tube is a procedure of value in rare cases only. Zöllner mentioned the placement of thin plastic tubing into the Eustachian tube. The plastic tube is removed from the nasopharynx after several weeks. This method was tried in some cases but tubal patency could never be maintained. Invariably two or three months later the tube was closed again. Today, if tubal patency cannot be established, we cover the middle ear with a meatal graft and intentionally leave a perforation over the round window. The patient is instructed to keep this perforation covered with a moist cotton ball. In this technique it is of importance to remove the tympanic mucous membrane in order to prevent annoying suppuration due to unavoidable infection. If the middle ear is lined with epithelium as is frequently the case in such patients, grafting is not necessary. The hypotympanum is covered with a moistened cotton ball in such a manner as to ensure a small air bubble in the round window niche allowing vibration of the window membrane.

Without any doubt this method is an unsatisfactory substitute but we have no other choice.

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https://doi.org/10.1017/S002221510005859X Published online by Cambridge University Press